

# **WVU Cooperative Agreement Decontamination Systems Information & Research Program Deployment Support Leading to Implementation**

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## **Introduction**

The Decontamination Systems Information and Research Program at West Virginia University is a Cooperative Agreement that focuses on research and development associated with hazardous waste remediation problems existing at Department of Energy, Corps of Engineers, and private sector sites. The Agreement builds on a unique combination of resources coupling university researchers with DOE sponsored small businesses, leading towards field tests and large scale technology demonstrations of environmental technologies. Most of the Agreement's projects are categorized in the Technology Maturity Levels under Gates 3-Advanced Development, Gate 4-Engineering Development, and Gate 5-Demonstration.

## **Objectives**

- Couple WVU researchers with DOE funded small businesses to solve problems and remove barriers to commercialization of remediation processes.
- Identify and initiate development and demonstration of workable systems to fill gaps in current technologies.
- Train and prepare students to enter into industrial and agency positions in waste and site remediation professions.

## **Approach**

The WVU Cooperative Agreement is divided into the areas of Research, Industry Cooperation and Outreach (Figure 1). FY97 research supports the following DOE focus areas: 1) Subsurface Contaminants, 2) Mixed Wastes, and 3) Decontamination and Decommissioning, and links 2 cross cutting areas: 1) Efficient Separations, and 2) Characterization, Monitoring and Sensor Technologies. The Confinement Test Center is a unique collaboration between WVU, BDM Federal, Inc., and the DOE/METC facility providing a test center for various barrier innovations.

The Outreach Program provides opportunities for university researchers to team with the small businesses supported by METC and also works with the West Virginia High Technology Consortium providing incubator resources. Industry partners work hand in hand with researchers from West Virginia University, Marshall University and University of North Dakota Energy and Environmental Research Center.

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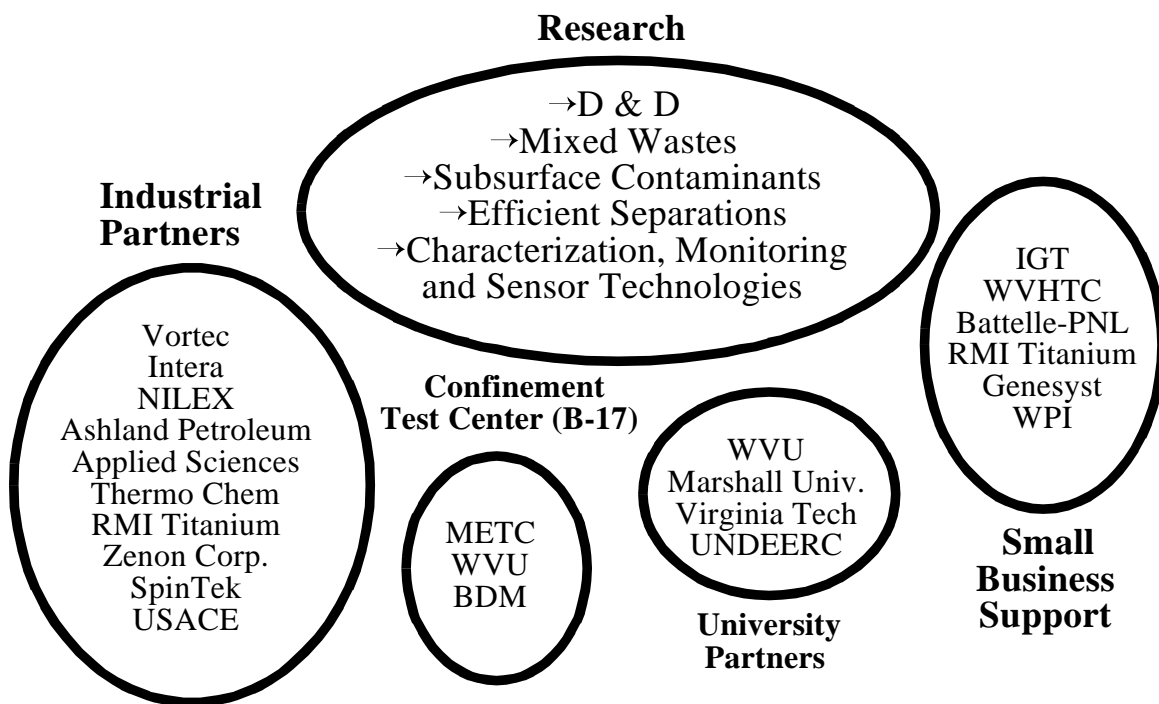


Figure 1: Organizational Structure

## Project Descriptions, Accomplishments and Benefits

The Research Program includes a diversity of projects bringing together a cadre of investigators. Key research projects are listed below under their respective focus area/cross cutting area.

### Subsurface Contaminants

Drain Enhanced Soil Flushing using Prefabricated Vertical Drains (M.A. Gabr): This project provides enhanced *in situ* soil flushing using prefabricated vertical drains (PVD) for remediation of contaminated sites where fine-grain soils are present. The research builds on the soil flushing process where remediation of contaminated aquifers using conventional pump-and-treat systems has shown to be ineffective and cost prohibitive. The technology is being developed with **NILEX Corporation**. Field demonstration is planned at an **Ashland Petroleum Corporation** gas station site. Pilot scale testing at the **Ashland Petroleum** site has already proven to be successful.

Performance and Characteristics Evaluation of Acrylates as Grout Barriers (M.A. Gabr): This research investigates the use of vinyl monomers as permeation grouts for *in situ* control of plume migration and waste confinement applications. This project couples engineers from **BDM Federal** with WVU researchers to support on-going research at the DOE/METC B-17 facility.

Standard Protocol and Barrier Design Models for Desiccation Barriers (K. Aminian & S. Ameri): This project researches circulating air barriers for achieving *in situ* containment of subsurface contaminants under tanks at DOE's Hanford and Savannah River sites. This project also couples engineers from **BDM Federal** with WVU researchers to support on-going research at the DOE/METC B-17 facility.

In Situ Bioremediation of Chlorinated Solvents (P. Carriers, W. Lin and W. Sack): This project researches the wide-spread problem of chlorinated aliphatic hydrocarbon contamination (CAH) in soil and groundwater at DOE sites. Work is progressing using *in situ* bioremediation as a polishing step following surfactant flushing of the contaminants. The technology has been successfully implemented at the lab scale in aerobic and anaerobic column studies to determine the rates of contaminant and surfactant degradation, daughter product removal, and nutrient addition techniques.

Development and Implementation of a Decision Support System for Management of the EM-50 Technology Development Program (R. Malinovsky): The efforts of this project will provide a means to organize and catalog various activities in the Office of Science and Technology Program in such a way that the decision makers can take full advantage of the portfolio of R&D projects to meet the needs of the DOE Weapons Complex cleanup. The final product will be a data base developed as a decision tool process to assist in analysis and prioritization of the technology development portfolio being sponsored by the DOE EM-50 program. A joint effort between WVU, **Waste Policy Institute** and Virginia Tech comprise this work.

A Prototype Database and Decision Support System (DDS) for Management of the EM-50 Technology Development Program (J. Denton): Decision support tools are being developed in this Subtask to aid in the process of prioritizing and selecting technologies consistent with the “Gate - Technology Maturity Levels” criteria used to evaluate projects for advancement to succeeding development phases, and considers costs, benefits and risks from the standpoint of the stakeholder. The finished project is intended to provide DOE with the capability to assist in funding decisions.

GIS - Based Infrastructure for Site Characterization and Remediation (J. Hooper and A. Lodgher): The primary goal of this work is to determine an effective Geographic Information System (GIS) based infrastructure for describing, characterizing, and remediating contaminated sites. Work is proceeding with the **U.S. Army Corps of Engineers** at a large contaminated site (WV Ordnance site in Mason County, WV).

## **Mixed Wastes**

Analysis of Vortec Cyclone Melting System (CMS<sup>TM</sup>) for Remediation of PCB Contaminated Soils (I. Celik): This project combines WVU researchers with the **Vortec Corporation**. The research focuses on providing information necessary for the design of retrofit components to an existing high temperature waste processing and recycling unit so the system can be used for remediating PCB (PolyChlorinated Biphenyls) contaminated soils via ex situ vitrification.

## **Mixed Wastes/Efficient Separations**

Treatment of Mixed Wastes via Steam Reforming (R. Turton): This research investigates the destruction efficiency of RCRA organics occurring in a steam reforming atmosphere. The research directly addresses the optimization of the second stage of a small industrial scale prototype plant developed by **ThermoChem Inc.**, Columbia, MD.

Use of Centrifugal Membrane Technology with Novel Membranes to Treat Hazardous/Radioactive Wastes (B. Reed): The objective of this research is to investigate the feasibility of using **SpinTek Centrifugal Membrane Technology** coupled with innovative membranes, such as those developed by **Zenon Corporation**, for the treatment and/or separation of hazardous/radiological wastes. The results of this work will be a technology that can treat a variety of wastes (contaminated groundwater, mixed-waste process water, waste residual, etc.). The process can be used for both inorganic (radionuclides and heavy metals) and organic contaminants.

Environmental Pollution Control Devices Based on Novel Forms of Carbon (J. Zondlo, A. Brennsteiner and A. Stiller): The purpose of this research is to assess the feasibility of an electrochemical system that uses high surface area carbon devices to remove heavy metals from aqueous streams. Cathodic carbon materials are being developed to maximize conversion efficiency. The system can be used to selectively remove and recover metal ions, and provides

for a detailed quantitative analysis of the metal ions in solution down to the parts per billion range. The technology is also applicable for the removal of some radionuclides from water. Industrial tie-ins have been made with the **Carbon Materials Group at Oak Ridge National Laboratory, Applied Sciences Inc., Concurrent Technologies Corporation, Zenon Corporation and Swanson Plating Company**.

Evaluation of Supercritical Gravity Pressure Vessel (SGPV) for Supercritical Water Oxidation (SCWO) (G. Rappe) : The objectives of this research being performed by **Genesyst International, Inc.**, are to perform a technology evaluation to determine the applicability of the Supercritical Gravity Pressure Vessel (SGPV) to waste streams in various DOE focus areas. The work will determine the applicability of the SGPV technology to low level mixed wastes. Comparisons will be made with two other SCWO technologies, as well as other thermal treatment systems.

### **Mixed Wastes/Characterization, Monitoring and Sensor Technologies**

Instrumental Methods for Characterization and Analysis of Nuclear Wastes and Environmental Contaminants (V. Remcho): This research focuses on novel detection strategies for the chemical speciation and quantitation of Technetium 99(<sup>99</sup>Tc) and Iodine 129 (<sup>129</sup>I) in simulated nuclear waste tanks and aquifer matrices. This effort is being facilitated by direct interaction with the **Battelle Memorial Institute at the Pacific Northwest National Laboratory**.

### **Decontamination and Decommissioning/Efficient Separations**

Environmental Pollution Control Devices Based on Novel Forms of Carbon (J. Zondlo, A. Brennstainer and A. Stiller): The purpose of this research is to assess the feasibility of an electrochemical system that uses high surface area carbon devices to remove heavy metals from aqueous streams. Cathodic carbon materials are being developed to maximize conversion efficiency. The system can be used to selectively remove and recover metal ions, and provides for a detailed quantitative analysis of the metal ions in solution down to the parts per billion range. The technology is also applicable for the removal of some radionuclides from water. Industrial tie-ins have been made with the **Carbon Materials Group at Oak Ridge National Laboratory, Applied Sciences Inc., Concurrent Technologies Corporation, Zenon Corporation and Swanson Plating Company**.

Production and Evaluation of Biosorbents and Cleaning solutions for use in Decontamination and Decommissioning (J. Kilbane): The objectives of this research are to prepare and evaluate biosorbents and cleaning solutions produced by **Institute of Gas Technology (IGT)** that may be useful in the decontamination and decommissioning of DOE facilities. The research is a collaborative project between WVU and **IGT** that addresses the filtration/liquid processing in order to be used in practical applications.

Use of SpinTek Centrifugal Membrane Technology and Sorbents/Cleaning Solutions for D&D Work (B. Reed): The feasibility of using centrifugal membrane technology to separate sorbents/cleaning agents used in decontamination and decommissioning is being investigated in this work. The project uses the **SpinTek Centrifugal Membrane** to filter the sorbents/cleaning agents developed through the efforts of the **IGT Biosorbents** project. Membranes designed by **Zenon Corporation** are also being investigated.

## **Outreach**

West Virginia High Technology Consortium Foundation (WVHTC) Environmental Technology Support Program (J. Berkow): The goals of this program are to facilitate technology transfer and commercialization of environmental technologies by linking entrepreneurs, capital, market and general know-how through start-up companies launched through the Environmental Technology Incubator.

Small Business Technical Based Support (E. Cook): This project was initiated to address problems with commercialization of innovative site remediation technologies developed by small businesses funded by DOE. Once a problem or opportunity is defined, researchers from WVU, Marshall University or other sources are solicited to work with the small business in a research effort to solve the problem or remove the barrier to commercialization of the process.

Approach for Assessing Potential Voluntary Environmental Protection, Kanawha Valley Area (R. Lovett): The objective of this project is to assess the interest and willingness of industry in the Kanawha River Valley, WV, to participate in discussions leading toward the voluntary cleanup of contaminated industrial sites using DOE developed technologies.

## **Future Activities**

Future activities include field demonstrations of the current projects, and continued concentration in the following areas:

- Interaction and support of small businesses
- Responding to DOE's Research Announcements (ROA's & PERDA's)
- Presentations of research at DOE and appropriate conferences

### **Contract Information**

Research sponsored by the U.S. Department of Energy, Morgantown Energy Technology Center.

### **Cooperative Agreement Number:**

DE-FC21-92MC29467

### **Period of Performance:**

10/1/92 - 9/30/97

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